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The Student Developmental Program provided in-service training through workshops, participation on curriculum committees, and special courses at local colleges. Conclusions about the effect of the Student Developmental Program on achievement were presented. Intergroup comparisons of achievement, interest, and personality were made of senior high school students. Results showed that there were no outstanding differences in personality and interests between the participants of the Student Developmental Program and the control group. However, differences were shown in achievement, for the participants in the Program consistently achieved higher. Other phases of evaluation showed the Student Developmental Program as being beneficial, or at least without negative effects, on the students. These were not described.

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THE STUDENT DEVELOPMENTAL PROGRAM

Second Report

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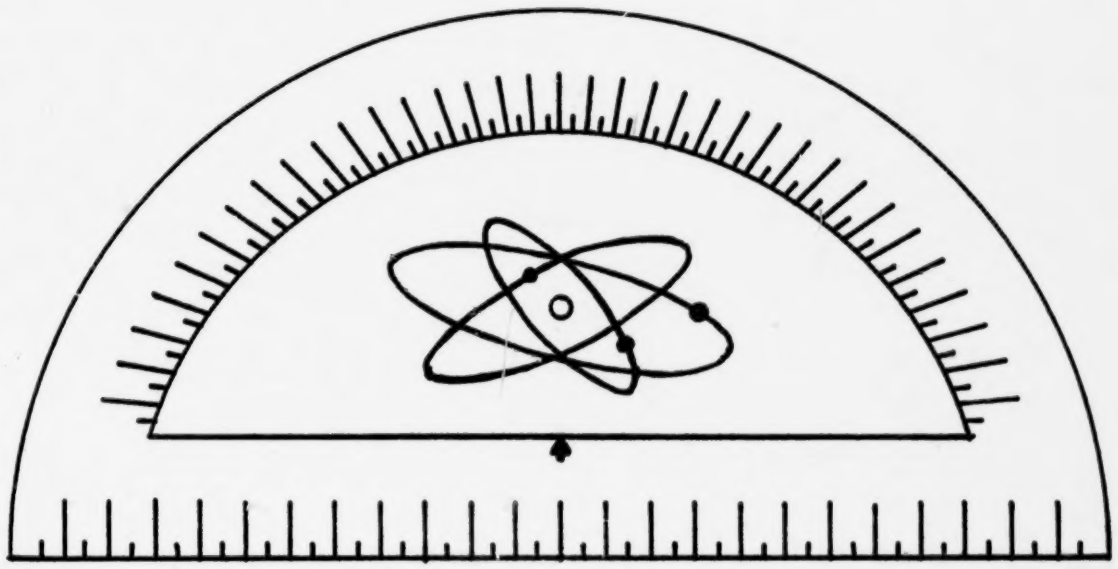

ST. PAUL PUBLIC SCHOOLS
Publication No. 270
September, 1962

THE STUDENT DEVELOPMENTAL PROGRAM

Second Report on a Program for Talented
Students in Mathematics and Science

by

Clyde R. Manchester and Norman E. Silberberg

Saint Paul Public Schools
Publication No. 270
Office of the Assistant Superintendent
Secondary and Vocational Education
September, 1962

This report is a continuation of the previously published report by the same authors entitled The Student Developmental Program - Preliminary Report, Saint Paul Public Schools, Publication No. 265, May 1962.

FOREWORD

The great strides currently being made in developing scientific knowledge and understanding and its accompanying threat to our national security are factors which cause the American public to carefully examine the curriculum content of our secondary schools for its effectiveness in preparing students to cope with these major developments. We in public education must evaluate the effectiveness of our existing curriculum and critically analyze suggested changes for its improvement. The Student Developmental Program was an experimental program directed to improving instruction for talented students in mathematics and science.

The Saint Paul Public Schools are indebted to the Louis W. and Maud Hill Family Foundation for its financial support of the experiment. The results are very significant at the local level and of great interest at the national level.

The authors in this and the first report (The Student Developmental Program - Preliminary Report, Publication No. 265, May 1962) have provided the results of this program at the student, staff, and community level with complete objectivity.

It has been obvious that there are by-products from this experimental program which, though not of an objective nature, have been noted by the staff, many of whom had not participated actively in the program. Evidence of their existence is objective, yet they are most observable.

The first of these is the impact this program has had on the desire of a great number of teachers to evaluate their particular teaching area in terms

of objectives, content, and teaching techniques. It was natural that changes occurred in the mathematics and science areas and that they were not limited to instruction of talented students alone. Changes therein contributed to the improvement of curriculum and teaching in all aspects of these two disciplines. As a result of this experiment, requests have been received for the opportunity to accomplish similar programs in areas such as English and social studies.

The Student Developmental Program provided in-service training through workshops, participation on curriculum committees, and special courses at local colleges. Workshops were observed to be most valuable and gained in prestige when used to implement changes made in the curriculum. In fact, the Student Developmental Program was successfully accomplished because of the assistance provided teachers through workshops which paralleled rather than preceded the introduction of new materials in the classroom.

With the introduction of the new program, experimentation has obviously been a motivating factor for both teacher and student. Apparently teachers found appeal and satisfaction in the new materials, and a positive effect on their approach to teaching has been observed. Students reacted positively to the challenge of being included in an experimental program. Those who took advantage of four years in the program evidenced greater accomplishments throughout their total school experience.

These by-products offer encouragement and provide direction to experimentation. Positive values growing out of this experiment appear in the objective data of evaluation.

Glenn F. Varner
Former Assistant Superintendent
Secondary and Vocational Education
Saint Paul Public Schools

THE SAINT PAUL STUDENT DEVELOPMENTAL PROGRAM
Second Report

Clyde Manchester and Norman Silberberg

The Saint Paul Student Developmental Program provides enrichment in the science and mathematics curriculums in all Saint Paul public high schools. The Student Developmental Program - Preliminary Report (Manchester and Silberberg, 1962b) fully describes the program and the results obtained from a study of the first group (class of 1957-61) to complete the entire four years of it. The Preliminary Report was descriptive in nature, but no conclusions were made on the effect of the program on achievement, due to there being no control group with which to make comparisons. This second report concerns the class which entered the program in ninth grade in September, 1958 and graduated in June, 1962, called the class of 1958-62. Here it is possible to compare achievement of this group with selected controls and thus to draw conclusions on the worth of the Student Developmental Program,

This second report does not cover as many areas of description as does the Preliminary Report, but is limited to intergroup comparisons of achievement, interest, and personality. The groups involved are all 1962 graduates of Saint Paul public high schools. They are:

1. "D" Group.

   Students completing all four years of the Student Developmental Program. This, the "D" Group, is comprehensively described in the Preliminary Report.

2. Drop-outs.

Students who entered the Student Developmental Program in the ninth grade, remained in the Saint Paul public school system without interruption, but left the program before graduation are called "Drop-outs." (Manchester and Silberberg, 1962).

3. All Controls.

The control group, as described in the Preliminary Report (p. 29-30), were randomly selected from the pool of students originally recommended for the "D" program. This group is referred to as "All Controls" and participates in the regular high school curriculum.

4. Selected Controls.

The "D" Group and All Controls were similar at the beginning of the ninth grade by virtue of the selection techniques utilized. However, approximately half of the students entering the "D" program dropped out before graduation while All Controls remained intact. It is recognized that after four years of high school the "D" Group had changed because of the drop-outs, while the control group remained unchanged. Therefore, in order to approximate a similarity to the "D" Group it was felt that those controls who completed six or more units in mathematics and science had evidenced a continuing interest in these subjects. They were used in comparisons with the "D" Group and are called "Selected Controls."

In this supplementary report, the achievement of the students who were in the Student Developmental Program is compared with that of controls and

conclusions on the worth of the program are made. This is done in two ways:

1. Given an evidenced interest in mathematics and science, does the "D" student achieve better than the Selected Controls?
2. Does less than complete exposure to the Student Developmental Program have an adverse effect on the achievement of the Drop-outs? This is done by comparing them with All Controls who, like the Drop-outs, have taken anywhere from two to seven units of mathematics and science.

DESCRIPTION OF GROUPS

Intergroup comparisons were made, comparing by sex the "D" Group to the Selected Controls, and secondly, the Drop-outs to All Controls. The reason for the latter comparison was to determine if the program had any adverse effect on the Drop-outs by contrasting them to a comparable group. It is recognized by the investigators that there is a question of the similarity between these two groups. However, it was felt that All Controls was the only group with which Drop-outs could be compared for two reasons:

1. Inclusion in the Drop-out group meant that students took from two to seven credits of mathematics and science. This would also be true of the All Controls group but would not be true if Selected Controls were separated out.
2. The IQs of Drop-outs and All Controls are very similar (see Table 1). This would not be true if the Selected Controls were separated from All Controls.

Table 1 shows the comparison of IQs for those groups which will also be compared on achievement. A value of t which is 1.96 or more is significant.[1] It can be seen from Table 1 that there are no significant differences between means for the "D" and Selected Controls, nor between the Drop-outs and All Controls. Thus we can assume that, within the limits of this study, differences which occur in achievement are due to school experiences rather than to intelligence.

Table 1

Comparison of Group IQs

Group	Boys		Girls	
	N	Mean	N	Mean
D	115	120.9	49	119.6
Selected Controls	24	117.5	12	122.2
t		1.66		1.12
Drop-outs	47	115.2	95	118.8
All Controls	38	115.0	38	119.4
t		<1		<1

Interests and Personality

Interests and personality, as measured by the Kuder Preference Record (KPR) and the Minnesota Counseling Inventory (MCI), were fully described for the "D" and Drop-out groups in the Preliminary Report. In order to ascertain the similarity between the "D" Group and Selected Controls, this study's primary contrast, statistical comparisons were made on each subscale of these instruments. It was found that no significant differences between these two groups exist on any subscale of either the KPR or MCI.

[1] The level of significance used in this study is .05.

High School Rank

It was communicated to the investigators by school counselors that, despite the reasons students gave for dropping out (Silberberg and Manchester, 1962), an important factor was an attempt to avoid the competition in "D" program classes and thereby raise their high school rank. It was shown in the Preliminary Report (p. 45-47) that this did not occur. In fact, students (especially boys) remaining in the Student Developmental Program to completion generally had higher high school ranks than those who dropped out.

Table 2

High School Rank Percentiles

	90-100		80-89.9		70-79.9		Below 70	
	N	%	N	%	N	%	N	%
Boys								
D Group	60	52.6	32	28.1	12	10.5	10	8.8
Selected Controls	13	54.2	5	20.8	3	12.5	3	12.5
Drop-outs	5	11.4	12	27.3	6	13.6	21	47.7
All Controls	13	35.1	7	19.0	5	13.5	12	32.4
Girls								
D Group	33	70.2	9	19.2	3	6.4	2	4.2
Selected Controls	8	72.7	3	27.3	0	0	0	0
Drop-outs	24	26.7	22	24.4	22	24.4	22	24.4
All Controls	12	37.5	9	28.1	6	18.8	5	15.6

High school rank was investigated somewhat differently for the class of 1958-59 than that reported for the class of 1957-58, the intent being to offer further validity of the group comparisons presented in this paper. Comparisons are to be made which assume that the "D" groups and Selected Controls are similar, and also that Drop-outs and All Controls are similar.

Table 2 shows the distribution of high school ranks for each group. Intergroup comparisons for boys and girls show no significant differences[1] between the "D" Group and Selected Controls or between Drop-outs and All Controls. These results are consistent with MCI, Kuder, and IQ results and seem to justify making intergroup comparisons in achievement.

Table 3

STEP Mathematics - May, 1962

	N	Mean	%ile Band	Midpoint of Band
Boys				
D Group	113	36.65	94-99	96.6
Selected Controls	21	29.33	72-95	83.5
t		4.40*		
Drop-outs	40	26.90	58-91	74.5
All Controls	35	27.31	63-93	78.0
t		0.27		
Girls				
D Group	50	32.42	89-98	93.5
Selected Controls	12	30.83	87-97	92.0
t		0.98		
Drop-outs	87	25.38	52-89	70.5
All Controls	30	27.17	58-91	74.5
t		1.42		

*Significant at .05 level.

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[1]Among boys, for "D" vs. Selected Controls, $\chi^2_3 = .08$, Drop-outs vs. All Controls, $\chi^2_3 = 6.9$. Among girls, for "D" vs. Selected Controls, $\chi^2_3 = 1.6$, Drop-outs vs. All Controls, $\chi^2_3 = 2.2$.

ACHIEVEMENT TESTING

Students in Student Developmental Program classes were administered a battery of achievement tests at the end of each grade. The complete program is described on pages 30-31 of the Preliminary Report.

The results on the first three years' testing for the class of 1958-62 appear in the Appendix. For each test area, these data compare the All Controls group with the students remaining in the Student Developmental Program classes at the end of each year. In other words, at the time of each testing noted in the Appendix, the experimental group does not include any of the drop-outs which have already occurred, but does include those drop-

Table 4

STEP Science - May, 1962

	N	Mean	%ile Band	Midpoint of Band
Boys				
D Group	113	38.70	81-95	88.0
Selected Controls	21	32.95	57-85	71.0
t		3.79*		
Drop-outs	40	31.63	50-81	65.5
All Controls	35	31.29	45-76	60.5
t		>1		
Girls				
D Group	50	35.74	69-90	79.5
Selected Controls	12	31.92	50-81	69.5
t		1.84		
Drop-outs	87	29.25	40-72	56.0
All Controls	30	29.87	40-72	56.0
t		0.47		

*Significant at .05 level.

outs which are yet to come. Since statistical differences were not consistent over the first three years, the results of natural selection are not too obvious until the last year of the program.

At the end of the senior year, student groups were administered a test battery including STEP (Sequestial Tests of Educational Program-Form 1A), mathematics, science, social studies, and writing, as well as the Cooperative mathematics Pre-test for College Students. These tests are described fully in the Preliminary Report. Briefly, STEP attempts to test the application of learned principles to new problems, while the Cooperative Mathematics

Table 5

STEP Social Studies - May, 1962

	N	Mean	%ile Band	Midpoint of Band
Boys				
D Group	113	44.63	68-87	77.5
Selected Controls	21	39.71	51-74	62.5
t		2.05*		
Drop-outs	40	35.58	34-58	46.0
All Controls	35	37.09	40-62	51.0
t		0.53		
Girls				
D Group	50	43.90	62-84	73.0
Selected Controls	12	40.33	51-74	62.5
t		1.26		
Drop-outs	87	37.87	40-62	51.0
All Controls	30	38.37	40-62	51.0
t		0.23		

*Significant at .05 level.

tests the mastery of particular skills. The results of this testing program appear in Tables 3 through 7.[1]

Among boys, the "D" group was significantly higher than the Selected Controls in all four STEP areas. Among girls, although the "D" group was higher in all STEP areas than Selected Controls, statistical significance did not occur. On the Cooperative Mathematics test, girls who were Selected Controls were significantly higher than the "D" group, while sig-

Table 6

STEP Writing - May, 1962

	N	Mean	%ile Band	Midpoint of Band
Boys				
D Group	113	39.50	57-89	73.5
Selected Controls	21	33.91	26-59	42.5
t		3.21*		
Drop-outs	40	33.68	25-57	41.0
All Controls	35	32.71	17-46	31.5
t		>1		
Girls				
D Group	50	42.98	72-94	83.0
Selected Controls	12	41.75	64-92	78.0
t		0.63		
Drop-outs	87	40.98	59-90	74.5
All Controls	30	41.60	64-92	78.0
t		0.43		

*Significant at .05 level.

[1]Percentile equivalents in Tables 3 through 7 are obtained from "Individual Score Norms" for college freshmen (fall testing) as given in each STEP Manual for Interpreting Scores. The norms used on the Cooperative Mathematics Pre-test for College Students are publisher's norms for entering freshmen.

nificant differences did not occur for boys. The same differences which occurred in mathematics and science also appeared in social studies and writing. The motivation toward higher school achievement of students who completed the Student Developmental Program seems general rather than limited to mathematics and science in comparison with students of similar ability and interest who were not in the Student Developmental Program.

Upon inspecting the above data, one could hypothesize that, among boys the differences which occur in achievement in favor of the "D" group may be a result of that group's higher mean IQ. However, it can be seen from

Table 7

Cooperative Mathematics Pre-test for
College Students, Form Y - May, 1962

	N	Mean	%ile
Boys			
D Group	113	32.15	88
Selected Controls	21	31.39	86
t		0.49	
Drop-outs	40	20.49	33
All Controls	35	26.86	66
t		2.97*	
Girls			
D Group	50	29.64	81
Selected Controls	12	34.08	93
t		2.01*	
Drop-outs	87	20.08	33
All Controls	30	23.37	46
t		1.55	

*Significant at .05 level.

Chapter V of the Preliminary Report that the mean IQ is the same for this year's boys who were Selected Controls and the boys in the "D" group last year. The fact that the mean IQ for male drop-outs in both years is the same and that the same per cent (34%) dropped out in both years would lead to the expectation that those boys remaining in the Student Developmental Program are basically the same from year to year. Therefore, to minimize the IQ factor, the boys in this year's Selected Controls and last year's "D" group were compared on the four STEP areas.[1] Statistical tests indicate that last year's "D" group achieved significantly higher[2] than this year's Selected Controls, even though the IQs were equal.

Among girls, none of the differences in STEP areas were significant between groups in the class of 1958-62. In this case, the Selected Controls had a higher mean IQ than did the "D" girls. It is suspected that, if the IQs were equalized, the consistently higher achievement scores for the "D" group may have become statistically significant.

The percentile equivalents noted in Tables 3 through 7 suggests that boys and girls completing the "D" program should be successful in mathematics and science in college. According to publisher's norms, their mean scores range from the 79th to 97th percentile for entering college freshmen, as well as their IQs being higher than those of typical college freshmen (see p. 41 in Preliminary Report).

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[1] For STEP results, class of 1957-61, see Chapter V in Preliminary Report.

[2] t values: mathematics - 6.56, science - 7.30, social studies - 6.21, and writing - 3.48, all significant at the .001 level.

CONCLUSIONS

The results of this Second Report on the Student Developmental Program are consistent with those obtained in the Preliminary Report. Using the Minnesota Counseling Inventory as the measure of personality, the Preliminary Report shows no dramatic changes occurring during their four years of high school for students participating in the Student Developmental Program, and the Second Report shows no differences at graduation between them and comparable students in the traditional curriculum. In assessing interests with the Kuder Preference Record, the Preliminary Report indicated that interests, as measured in the freshman year, are one of the best predictors of completion of the program. At graduation no differences in interests were found between "D" students and controls who take most of the available courses in mathematics and science.

Taking a heavy load of mathematics and science in high school, whether in the Student Developmental Program or not, is concomitant with higher high school rank than is obtained by controls who take less than six units of mathematics and science or by Drop-outs.[1] An individual student's high school rank seems to be dependent on other factors than the length of time he participated in the Student Developmental Program.

On an achievement test purporting to measure the ability to apply learned principles, students completing the Student Developmental Program consistently achieved better than comparable controls. This is not only true in mathematics

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[1] It is unknown how much mathematics and science was taken by the Drop-outs as a group. As individuals, they took anywhere from two to seven units of these subjects.

and science, but there is evidently a carry-over effect resulting in higher achievement in social studies and writing. Benefits in achievement from the "D" program seem to be cumulative, clear-cut differences not appearing until the senior year. Results on tests dealing with the traditional curriculum do not indicate the above differences in achievement between groups, and in fact, in some cases the Student Developmental Program seems to be detrimental to achievement on these tests. It is felt that the benefits of the skills in application will more than make up for the lack of emphasis on certain traditional materials.

In summary, results in this report and in the Preliminary Report have consistently shown higher achievement for students which may be attributable to the Student Developmental Program. Other phases of evaluation show the Student Developmental Program as being beneficial or at least being without negative effects on the student. In each phase of the design of the evaluation, one could speculate on the influences of other variables. However, the consistency of results favoring the Student Developmental Program dictates its continuance in the Saint Paul high school curriculum, and that appropriate students should be counseled to participate in all four years of the program. It appears that "natural selection" has been occurring among boys, thus differentiating drop-outs from those remaining in the program and most able to benefit from it. However, it appears that the reason that the superiority of "D" girls over girls in the Drop-out group is not as dramatic is that girls with characteristics for success in the Student Developmental Program are being counselled out of it because of individual misconceptions concerning the value of mathematics and science to girls. This is seen as a con-

tinuation of society's failure to encourage girls to follow "unfeminine" professions, thus leaving untapped a large portion of the nation's resources.

On page 27 of the Preliminary Report, the rationale for evaluating the Student Developmental Program was given:

> "Evaluation of the experimental program is concerned with finding if the Student Developmental Program works. The way to determine this is to find out if the talented student participating in the "D" program achieves more educationally than does a comparable student participating in the established curriculum open to all students."

The Student Developmental Program has been proven as valuable, and should be retained as part of the Saint Paul curriculum.

APPENDIX

Table A

Class of 1958-62 - 9th Grade Achievement Testing
Spring, 1959

	N	Mean	Percentile Band[a]	Midpoint of Band
STEP Mathematics - Form 3A				
Boys - "D" Group	184	41.13	99-100	99.5
All Controls	44	39.45	99-100	99.5
t		1.70		
Girls - "D" Group	150	39.79	99-100	99.5
All Controls	35	40.06	99-100	99.5
t		0.29		
STEP Science - Form 3A				
Boys - "D" Group	182	49.07	99-100	99.5
All Controls	43	49.28	99-100	99.5
t		0.19		
Girls - "D" Group	150	48.31	99-100	99.5
All Controls	35	47.05	99-100	99.5
t		1.50		
STEP Social Studies - Form 3A				
Boys - "D" Group	179	60.84	99-100	99.5
All Controls	43	59.84	99-100	99.5
t		0.97		
Girls - "D" Group	146	59.88	99-100	99.5
All Controls	35	58.97	99-100	99.5
t		1.25		
STEP Writing - Form 3A				
Boys - "D" Group	182	46.48	99-100	99.5
All Controls	44	41.80	94-99.1	96.55
t		5.62*		
Girls - "D" Group	150	46.92	99-100	99.5
All Controls	35	48.43	99-100	99.5
t		1.66		

Table A continued

	N	Mean	Percentile Band[a]	Midpoint of Band
Lankton Algebra[b]				
Boys - "D" Group	181	39.41		92
All Controls	42	34.57		83
t		3.52*		
Girls - "D" Group	150	37.39		88
All Controls	32	35.78		86
t		1.40		
Cooperative Biology[c]				
Boys - "D" Group	181	48.04		38
Girls - "D" Group	148	45.60		29

*Significant at .05 level.

[a]Step norms used are for fall testing, 10th grade.

[b]Publisher's end-of-year percentile norms.

[c]Publisher's norms for high school students with one year of study in biology.

Table B

Class of 1958-62 - 10th Grade Achievement Testing
Spring, 1960

	N	Mean	Percentile Band[a]	Midpoint of Band
STEP Mathematics - Form 2A				
Boys - "D" Group	154	36.31	98-100	99
All Controls	37	32.49	97-99.7	98.35
t		2.15*		
Girls - "D" Group	121	31.26	96-99.6	97.8
All Controls	29	29.97	94-99	96.5
t		0.26		
STEP Science - Form 2A				
Boys - "D" Group	154	37.95	84-97	90.5
All Controls	37	36.24	78-95	86.5
t		0.77		
Girls - "D" Group	121	32.82	68-91	79.5
All Controls	29	31.55	62-88	75.0
t				
STEP Social Studies - Form 2A				
Boys - "D" Group	154	46.23	95-99	97
All Controls	37	45.05	95-99	97
t		0.46		
Girls - "D" Group	121	44.81	95-99	97
All Controls	29	44.28	94-98	96
t		>1		
STEP Writing - Form 2A				
Boys - "D" Group	154	40.49	85-95	90
All Controls	37	38.00	77-92	84.5
t		1.18		
Girls - "D" Group	121	43.59	91-98	94.5
All Controls	29	44.21	91-98	94.5
t		>1		
Cooperative Chemistry[b]				
Boys - "D" Group	154	39.90		53
Girls - "D" Group	123	32.02		37

*Significant at .05 level.

[a]Norms used are for fall testing, 11th grade.

[b]Publisher's norms for "most typical group."

Table C

Class of 1958-62 - 11th Grade Achievement Testing
Spring, 1961

	N	Mean	Percentile Band[a]	Midpoint of Band
STEP Mathematics - Form 2B				
Boys - "D" Group	137	38.57	98-100	99
All Controls	35	36.06	98-100	99
t		2.06*		
Girls - "D" Group	72	36.36	98-100	99
All Controls	27	32.89	96-99.1	97.55
t		2.66*		
STEP Science - Form 2B				
Boys - "D" Group	137	38.97	85-98	91.5
All Controls	35	37.17	81-97	89.0
t		1.41		
Girls - "D" Group	72	35.32	78-95	86.5
All Controls	27	32.74	69-92	80.5
t		2.03*		
STEP Social Studies - Form 2B				
Boys - "D" Group	137	51.76	95-99	97
All Controls	35	50.06	93-97	95
t		1.05		
Girls - "D" Group	72	50.53	94-98	96
All Controls	27	48.04	92-96	94
t		1.39		
STEP Writing - Form 2B				
Boys - "D" Group	137	39.71	76-93	84.5
All Controls	35	38.43	73-92	82.5
t		0.76		
Girls - "D" Group	72	45.54	92-99	94.5
All Controls	27	43.63	88-97	92.5
t		1.47		
Cooperative Chemistry[b]				
Boys - All Controls	10	41.8		57
Girls - All Controls	7	23.57		20

*Significant at .05 level.

[a]Step norms used are for fall testing, 12th grade.

[b]Publisher's norms for "most typical group."

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